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REMOVAL SITE EVALUATION FOR SITEWIDE ASBESTOS ABATEMENT PROGRAM AUGUST 1992

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ATTACHMENT III

Removal Site Evaluation for RA #26

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TECHNICAL INFORMATION FOR

REMOVAL SITE EVALUATION

AUGUST 1992

Sitewide Asbestos Abatement Program

TABLE OF CONTENTS

1.0 Introduction

The majority of the facilities at the Fernald Environmental Management Project (FEMP) were constructed prior to 1970, and therefore asbestos containing materials (ACM) were utilized in various building materials. Insulation materials containing asbestos were used for pipelines, ductwork and vessels requiring thermal insulation. Transite (asbestos-cement board) was widely used for inner and outer building sheathing for many process buildings, warehouses, and support buildings. Floor coverings containing asbestos were used in offices, laboratories, and service areas. Asbestos was also used in miscellaneous materials such as gaskets, brake and clutch linings, lab oven linings, electrical conduit, and plant oven linings/seals.

Currently, the FEMP has an active, ongoing asbestos abatement program.

This Removal Site Evaluation (RSE) has been completed by the DOE under authorities delegated by Executive Order 12580 under Section 104 of CERCLA and is consistent with Section 300.410 of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). This RSE addresses whether current asbestos abatement activities at the FEMP satisfy CERCLA requirements.

2.0 Source Term

There are two sources for characterizing ACM at the FEMP. The first source is the Asbestos Site Survey, and the second is the Transite Fiber Migration Study.

2.1 A comprehensive Asbestos Site Survey was completed in February of 1992. This Survey detailed the location of ACM; assessed the hazardous nature of ACM, and recommended response actions.

The protocol used for sampling and analysis was in accordance with the Asbestos Hazard Emergency Response Act (AHERA). (Although AHERA was developed for application in public and private schools, it has been universally accepted as the "de facto" standard of care to be used for other types of facilities.)

Bulk samples were taken of any material that was suspected to contain asbestos, and these samples were analyzed by an accredited laboratory. If asbestos was present, results were reported not only as a percentage of the sample, but also by type of asbestos - chrysotile, amosite, etc.

Figure A-1 shows the data from the Site Survey by category of usage. From this table it can be seen that while there are 29 different categories of usage of ACM at the FEMP, by far the most extensive are the 62,874 linear feet of pipe insulation and lagging, and the 2,424,218 square feet of transite sheet material.

The Asbestos Site Survey indicated that of the 26 transite-cladded facilities at the FEMP, 4 buildings had transite panels that were in deteriorated condition and posed either safety or health problems.

These areas are:

Plant 2/3 - Digestion Area, and the West End of the Extraction Area

Plant 6 - Scrap Pickling Area

Metal Dissolver Building - Exterior

Hot Raffinate Building - Two Interior Areas

2.2 To determine if asbestos fibers were being released from the surface of transite panels, a Transite Fiber Migration Pilot Study was initiated and completed in February, 1992. The experimental design of the pilot study included collection of surface soil samples from soils adjacent to transite-clad buildings, gutter sediment samples, surface dust samples from sidewalks and pavements, and air samples related to the routine sweeping of streets.

2.2.1 Soil Samples - Table I

Buildings 2a, 4a, and 20a were selected as test sites for soil sampling. All of these buildings have gravel-covered soil in direct contact with the buildings' concrete foundations. Sampling locations at each building were chosen following a simple sampling protocol. When possible, samples were taken three feet away from the building foundation and evenly spaced along the side of the building.

Six surface soil grab samples were collected at each test site. The area to be sampled was marked using a 10 cm. x 10 cm. (100 sq. cm.) template. Enough soil to fill a 125 cu. cm. precleaned glass bottle (VWR Cat. No. 16194-041) was collected at each sampling location to an approximate depth of 1 cm. with the aid of a stainless steel spatula. Sampling was performed after removal of surface gravel. The gravel layer at each sampling location varied from 1/4 inch to several inches in depth. The inclusion of some gravel with each soil sample, especially when sampling in sandy soils, was unavoidable.

A set of control soil samples were collected at a transite-free building known as Building #73 Fire Brigade Training Center located about 100 yards outside the north security fence of the production area. These samples were humus rich soils characteristic of the farm land which surrounds the facility.

The sample preparation and analytical method used was based on the methodologies proposed by Hayward and Lowe, and Kramer and Millette as follows:

Once in the laboratory, the individual soil samples were dried and then inspected under a stereo-microscope and photographed. Each sample was then divided into two similar portions. One portion was kept intact for archive purposes, while the remaining portion was dried, weighed, ashed in a muffle furnace at 480 degrees C for 8-12 hours, and weighed again to determine the amount of organic material present. At this point, all samples from each test site were combined to yield one homogeneous composite sample per test site. Homogenization was accomplished using a tumbler designed and built in the laboratory for this purpose. The ashed composite samples were then ground in a SPEX Mixer Mill for one minute. This grinding time was sufficient to produce individual fibers or small fiber bundles as required by the analytical method.

Preparation of the samples for transmission electron microscopy (TEM) analysis followed. Six sub-samples (aliquots) from each composite soil sample were prepared. A 0.01-g aliquot of the ground sample was suspended in 100 ml of ultra pure deionized water. One Ml of 0.1% aerosol OT (10% solution of sodium dioctyl sulfosuccinate) was added to this suspension to ensure uniform fiber dispersion. The suspension was then mixed thoroughly and sonicated for one hour. Suspended particulates were collected onto a 0.45 micrometers mixed cellulose ester (MCE) filter membrane by filtering a 1-Ml aliquot of the total suspension. Once dried, the MCE filter was prepared for TEM analysis in accordance with the standard protocol described in the Asbestos Hazard Emergency Response Act (AHERA) final rule ($) CFR 763, Appendix A to Subpart E).

Prepared TEM sample grids were analyzed following the EPA Level II provisional method. The asbestiform particulates (particles having at least a 3 to 1 length to width ration) were counted and identified at a screen magnification of 15,000 to 20,000X. Identification of asbestos was accomplished by using morphology, selected area diffraction (SAED) and energy dispersive x-ray analysis (EDXA). The mass of each asbestos fiber was calculated by multiplying the volume of the fiber (assumed to be a cylinder) by the density of asbestos (2.55 g/cu. cm. for chrysotile, 3.3 g/cu. cm. for amphiboles). The results were expressed in micrograms of asbestos per gram of soil and in weight percent. The analytical sensitivity of the method was based on one fiber 0.2 micrograms in length and 0.05 micrograms in width. The quantifiable limit of detection was based on 4 fibers 1.26 micrometers in length and 0.08 micrometers in width.

Asbestos structures detected were primarily chrysotile. Very few amphibole structures were detected.

The results for analyses for asbestos content of soil samples are summarized in Table I. All samples analyzed for buildings 2a and 4a showed concentrations of asbestos above quantifiable detection limits. Note that detection limits may vary between samples, since this parameter is directly dependent on the dilution factors used to obtain adequate filter loadings suitable for TEM analysis. Two of the control samples showed asbestos concentrations above the detectable limit. Average asbestos concentration in the soil samples collected around building 2a were nearly 40 times greater than for those samples from building 4a. None of the samples contained asbestos in quantities greater than one percent by weight.

The observed high variability associated with the results within groups of samples is most likely attributable to the low asbestos concentration present in these samples. The quality control analyses performed on samples SO2-3, SO2-5 and SOC-3 reflected the same degree of variability. Regardless of this variability, it is reasonable to state that the asbestos concentration of soil samples collected in the vicinity of transite-clad buildings is considerably greater than that of control samples.

2.2.2. Gutter Sediment Samples - Table II

The buildings selected for this study were 2a, 5, 2d, and 12. While buildings 2a and 5 were selected as having asbestos roofs representative of the typical deteriorated condition found in most transite clad buildings, building 2d was selected as a worse case condition. The asbestos cladding in this building, which housed the nitric acid metal dissolver process, showed signs of extreme deterioration. Building 12, which is a cinder block addition to building 12a (a transite-clad building) and which has a flat built-up roof, was selected as a "control" building. Detection of asbestos fibers in the gutter sediments of this building would suggest migration of fibers from adjacent asbestos roofs.

Three gutter samples were collected from accessible locations at each of the four buildings selected. When possible, the three gutter samples were collected at evenly spaced locations along the length of the gutter. Gutters sampled were at least 25% full. Each sample was collected using a small gardening shovel in enough quantity to fill a 125 cu. cm. precleaned graduated glass bottle (VWR Cat. No. 16194-041).

Samples were processed, prepared for analysis and analyzed by TEM following the same procedure used for soil samples.

Chrysotile was the only type of asbestos detected in these samples. The structures detected were represented by individual fibrils, bundles, and a few clusters. The analytical results for the gutter samples collected are shown in Table II. Asbestos was detected in all samples in quantities above the quantifiable detection limit. Asbestos weight concentration ranged from 0.2 to about 10 percent.

2.2.3 Surface Dust Samples from Sidewalks/Pavements - Table III

Three microvacuum samples each were collected on the adjacent sidewalks and pavements of buildings 2d, 4a, and 20a as described above. Building 20a was selected as a case of a transite-clad building without gutters. A set of control samples were also taken at the Building 73 Fire Brigade Training Center. Prior to sampling, the pump and cassette assembly was calibrated to approximately 8 L/min. Sampling areas were located one foot from the wall and evenly spaced along or around the building sampled. The 100-cu. cm. area was vacuumed by lightly dragging the nozzle of the microvacuum across the marked sampling area. The area was vacuumed for about 30 seconds in one direction and another 30 seconds in a direction 90 degrees to the first. After vacuuming, the cassette assembly was turned upright so that the nozzle faced up before shutting off power to the pump. The nozzle was then removed and placed inside the cassette. Finally, the cassette was capped, labeled and stored upright in a clean sample box.

In general, dust samples were collected and analyzed following the EPA draft test method for sampling and analysis of dust for asbestos structures by transmission electron microscopy. The samples were collected by vacuuming a 10 cm. x 10 cm. area with a standard "closed face" 25-mm asbestos air sampling cassette loaded with a 0.45 micrometer MCE filter membrane, fitted with a one-inch long plastic tubing nozzle, and connected to a sampling pump with flexible tubing. This sampling technique has become known in the asbestos industry as the "microvacuum technique". The sample was then transferred from inside the cassette to an aqueous solution of known volume. Aliquots of the solution were then filtered through a 0.45 micrometer MCE filter membrane. A section of the filter was prepared following standard preparation methods and transferred to TEM grids for analysis. The asbestiform particulates were sized and counted by TEM at a screen magnification of 15,000 to 20,000X as specified in the Asbestos Hazard Emergency Response Act (AHERA) final rule (40 CFR 763, Appendix A to subpart E). The results were expressed as structures per square centimeter (s/sq. cm.) of measured surface area. The desired analytical sensitivity for the method was 200 s/sq. cm. Counting rules require stopping the analysis on the 21st grid opening or on the grid opening that contained the 100th structure, whichever occurred first.

As the results in Table III indicate, asbestos structures were detected in all of the samples, including those taken at the control building. Most of the structures observed were less than 5 micrometers in length. No asbestos forms other than chrysotile were detected in these samples.

2.2.4 Surface Dust Samples from Roofs - Table IV

To gain an understanding of the release factors of asbestos fibers from the corrugated transite roofs, three microvacuum samples each were collected at buildings 2d, 2a, 5, and 20a. These samples were collected about two feet in from the roof edge in the same manner described above.

Because of the high fiber loading obtained for these samples, the desired analytical sensitivity of 200 s/ cu. cm. could not be achieved. Thus, the recommended aliquot dilution factor of the aqueous solution had to be significantly decreased in order to obtain adequate particle loadings on the TEM grids.

2.2.5 Airborne Asbestos Concentration Before and During Street Sweeping Activity - Tables V and VI

One street sweeping activity was monitored. Five background air samples were collected in the afternoon of January 21, 1992. The streets were not swept on that day. Two days later, five air samples were collected while the streets were being swept. Air samples were collected using stationary high flow pumps calibrated at approximately 10 L/min. Sampling pumps were placed by curb side or on sidewalks in the route of the sweeper. Samples were collected at a height of approximately 36 inches above the pavement or sidewalk. Background samples were collected over a period of about three hours. Sampling time for the air samples collected during the street sweeping episode was about five hours.

Air samples were collected on standard 25-mm asbestos sampling cassettes loaded with 0.45 micrometer MCE filter membranes. Filters were prepared for TEM analysis in accordance with the standard protocol described in the Asbestos Hazard Emergency Response Act (AHERA) final rule (40 CFR 763, Appendix A to Subpart E). Prepared TEM sample grids were analyzed following the EPA level II provisional method and a PCM Equivalent analysis. In the latter method, an area equivalent to that used in the NIOSH 7400 method is analyzed and only asbestos fibers or bundles with an aspect ratio of 3:1, a width greater than 0.3 micrometers, and a length greater than 5 micrometers are used to estimate the average fiber concentration.

3.0 Potential Magnitude of Threat

3.1 Per the AHERA format described in Section 2.1, any ACM identified in the Asbestos Site Survey that was assessed in Hazard Rankings #4 through #7 required abatement (see Figure #2). The number of facilities in each category are as follows:

Hazard Rank	Description	No. of Homogeneous Areas
4	Damaged	136
5	Damaged, plus Potential for Damage	91
6	Damaged, plus Potential for Significant Damage	6
7	Significantly Damaged	75

The above homogeneous areas have been further graded for priority abatement, and abatement of these areas is being performed on a regular basis by a dedicated group of fully trained workers known as the "Asbestos Team". (Note: as of 8/5/92, 34 of the above homogeneous areas have been abated and asbestos work orders have been written for 52 others.)

The potential magnitude of threat is minimized by properly managing ACM in place. This is achieved by the above abatement efforts, periodic re-inspections of all facilities, and the procedures outlined in the Asbestos Operations and Maintenance Work Practices document.

The six areas of damaged transite mentioned in Section 2.1 have been evaluated in a study performed by Lockwood Greene Engineering. The results of this study have been turned over to Parsons, with instructions to develop appropriate response actions.

3.2 Due to its complexity, an exhaustive Transite Fiber Migration Study which would address the influence of all the parameters and variables which affect the release, deposition and migration of asbestos fibers due to the weathering of transite panels at the FEMP was not considered to be practical or economically feasible. The investigations undertaken with the pilot study have provided the necessary data to determine the existence of asbestos contamination in the different migration pathways identified.

However, because of the sampling restrictions and limited number of observations in each of the investigations of this pilot study, extensive statistical treatment of the data was not considered appropriate. For convenience, arithmetic means are provided for groups of samples representing similar sampling events.

3.2.1 Soil Samples

Surface soil adjacent to transite-clad buildings showed low levels of asbestos contamination above background. The analytical results indicate that the soils sampled contain asbestos in quantities estimated to be less than one percent by weight. Unfortunately, this observation cannot be generalized to all surface soils at the FEMP due to the sampling limitations imposed by the nature of the pilot study.

Simple comparison of the soil analysis results for Buildings 2a and 4a suggests, as reasonably expected, that a direct relationship exists between the degree of deterioration observed in a building and the concentration of asbestos in the soil.

3.2.2 Gutter Sediment Samples

The results of the analyses of the gutter sediment samples showed that the asbestos concentration in samples collected varied between 0.2 to 10 percent by weight. The results indicate a rough relationship between the degree of deterioration of the roof and concentration of asbestos in the gutter sediments.

3.2.3 Surface Dust Samples from Sidewalks/Pavements

Simple comparison of the results in Table III show that the asbestos structure density in sidewalks and pavements adjacent to transite-clad buildings is 100 to 1,000 times the structure density found at the control building. The high degree of flaking and delamination of the walls of Building 2d is probably related to the higher surface contamination observed in the adjacent sidewalks.

Compared to indoor guidelines, the concentration of asbestos in surface dust sampled from sidewalks and pavements are considerably elevated. According to some researchers, concentrations over 1,000 s/sq. cm. should be considered high. Concentrations over 100,000 s/ sq. cm. have been found when an abatement barrier has been breached. Although the vast majority of the asbestos structures detected in these samples were shorter than 5 microns, the potential for respirable emissions if surface dust is disturbed has to be considered great.

On the other hand, surface contamination around Building 4a, whose walls are in relatively good condition, was much lower. An intermediate condition is reflected by the results obtained for Building 20a, whose walls are not as deteriorated as those of Building 2d.

3.2.4 Surface Dust Samples from Roofs

Table IV summarizes the results of the analyses of the surface dust samples collected on transite roofs. These results clearly demonstrate the ease by which asbestos fibers are dislodged from the deteriorated surfaces of transite roof panels. Although critical visual inspections of the roof surfaces were not a part of the study, simple observations of roof surface conditions suggest that heavily deteriorated surfaces, such as those observed in Buildings 2d and 5, are associated with the release of higher amounts of asbestos fibers. These results are also in agreement with the asbestos concentration found in the gutter samples collected at these buildings.

The large amount of asbestos detected in the surface dust samples from roofs is indicative of the ease by which asbestos fibers can be released from the surface of deteriorated roofs. The data generated in the pilot study do not allow the determination of the quantity of asbestos that is generated by the action of rain, wind, and other phenomena. Estimates are that weathered and corroded transite roofs can release as much as 3 grams of asbestos per square meter per year. Using this emission factor, it can be estimated that the total amount of asbestos from the 26,400 square meters of transite roof surfaces at the FEMP could be as high as 174 pounds of asbestos per year. It is further estimated that about 80 percent of the asbestos is washed out by rain water and 20 percent is released to the ambient air, which may explain why the asbestos content is higher in gutter sediments than in the soils.

3.2.5 Airborne Asbestos Concentration Before and During Street Sweeping Activity

Tables V and VI show the results for the area air samples collected before and during the street sweeping activity. The asbestos structure concentrations obtained by these two methods are in agreement with typical ambient air samples in urban environments. These results suggest that the mechanical street sweeping is not likely to be a source of asbestos emissions which merits concern.

4.0 <u>Assessment of Need for a Removal Action</u>

Consistent with Section 40 CFR 300.410 of the National Contingency Plan, the Department of Energy (DOE) shall determine the appropriateness of a removal action. Eight factors to be considered in this determination are listed in 40 CFR 300.415 (b) (2). The following apply specifically to the above background concentration of asbestos occurring in the soil adjacent to buildings, gutters, dust at the FEMP site.

40 CFR 300. 415 (b) (2) (i)

Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.

40 CFR 300. 415 (b) (2) (ii)

Actual or potential contamination of drinking water supplies or sensitive ecosystems.

40 CFR 300. 415 (b) (2) (iv)

High levels of hazardous substances or pollutants or contaminants in soil largely at or near the surface, that may migrate.

40 CFR 300. 415 (b) (2) v)

Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

40 CFR 300. 415 (b) (2) (vii)

The availability of other appropriate federal or state response mechanisms to respond to the release.

40 CFR 300. 415 (b) (2) (viii)

Other situations or factors that may pose threats to public health or welfare or the environment.

5.0 Appropriateness of a Response

The driving force for the appropriateness of a response is 40 CFR 300.415 (b) (3), and 40 CFR 300.415 (b) (4) (i) and (ii).

If it is determined that a response action is appropriate due to both the level of contamination found in the soil adjacent to the buildings, gutters, curb surfaces, and dust at the FEMP Site and the potential of a contaminant migration, a removal action may be required to address the existing situation.

If a planning period of less than six month exists prior to initiation of a response action, DOE will issue an Action Memorandum. The Action Memorandum will describe the selected response and provide supporting documentation for the decision.

If it is determined that there is a planning period greater than six months before a response is initiated, DOE will issue an Engineering Evaluation/Cost Analysis (EE/CA) Approval Memorandum. This memorandum is to be used to document the threat of a public health and the environment and to evaluate viable alternatives response action. It will also serve as a decision document to be included in the Administrative Record.

Figure #1

Summary of ACM at the FEMP by Category

ACM CATEGORY	QUANTITY	UNIT
Acoustic Panels (2" x 4')	144	SF
Acoustic Tile Mastic	33,600	SF
Boiler Insulation	8,270	SF
Debris Samples	1	EA
Duct Insulation	7,620	SF
Fabric/Rope	32	LF
Fire Retardant Clothing	54	EA
Stored Firebrick	15	SF
Floor Tile Mastic	101,208	SF
Flue Insulation	4	LF
Gasketry	418	LF
Heat Shield	5	SF
HVAC Flexible Connector	44	EA
Insulation	100	SF
Joint Compound	33	SF
Other (Tar Insulation)	20	SF
Pipe Fitting Insulation	10,708	EA
Pipe Fitting Insulation Lagging	38	SF
Pipe Run Insulation	60,726	LF
Pipe Run Insulation Lagging	2,148	LF
Resilient Floor Tile (12" x 12")	3,232	SF
Resilient Floor Tile (9" x 9")	131,161	SF
Roof Flashing	290	SF
Smoke Stack Insulation	2,400	SF
Storage Tank/Exchanger Insulation	8,921	SF
Storage Tank/Exchanger Lagging	4,003	SF
Transite Pipe	111	LF
Transite Sheet Material	2,424,218	SF

SF = Square Foot

EA = Each

LF = Linear Foot

FIGURE #2

RESPONSE ACTIONS BASED ON HAZARD RANKING

Hazard Rank	Removal Priority	AHERA Categories	Response Actions Required by AHERA
7	1	Significantly Damaged	Evacuate or isolate the area if needed. Remove the ACBM (or enclose or encapsulate if sufficient to contain fibers). Repair of thermal system insulation is allowed if feasible and safe. O&M required for all friable ACBM.
6	2	Damaged + Potential for Significant Damage	Evacuate or isolate the area if needed. Remove, enclose, encapsulate, or repair to correct damage. Take steps to reduce potential for disturbance. O&M required for all friable ACBM.
5	3	Damaged + Potential for Damage	Remove, enclose, encapsulate, or repair to correct damage. O&M required for all friable ACBM.
4	4	Damaged	Same as hazard rank 5
3	5	Potential for Significant Damage	Evacuate or isolate the area if needed. Take steps to reduce potential for disturbance. O&M required for all friable ACBM.
2	6	Potential for Damage	O&M required for all friable ACBM.
1	7	No Problem	O&M required for all friable ACBM, but measures need not be as extensive as above.

Note: AHERA does not account for combinations of current and potential damage (i.e., hazard ranks #5 and 6). The response actions shown are combinations of those required for each condition.

TABLE I. Results of the Asbestos Analysis of Soil Samples

	Sample ID	µg/g	% Asbestos	Detection Limit µg/g
Bldg. No. 2a	SO2-1	1761.3	0.18	8.96
	SO2-2	838.9	0.08	8.96
	SO2-3	8299.2	0.83	8.96
	SO2-4	2131.1	0.21	8.96
	SO2-5	740.7	0.07	11.23
	SO2-6	1637.8	0.16	8.96
	Arithmetic Mean	2568.2	0.26	----
Bldg No. 4a	SO4-1	22.1	<0.01	9.49
	SO4-2	108.8	0.01	9.49
	SO4-3	56.2	<0.01	9.49
	SO4-4	68.4	<0.01	9.49
	SO4-5	41.1	<0.01	9.49
	SO4-6	114.9	0.01	9.49
	Arithmetic Mean	68.6	<0.01	----
Bldg No. 20	SO20-1	388.4	0.04	9.40
	SO20-2	193.4	0.02	9.40
	SO20-3	175.8	0.02	9.40
	SO20-4	62.4	<0.01	9.40
	SO20-5	103.0	0.01	9.40
	SO20-6	113.1	0.01	9.20
	Arithmetic Mean	172.7	0.02	----
Control	SOC-1	<8.8	<<0.01	8.8
	SOC-2	<8.8	<<0.01	8.8
	SOC-3	<8.8	<0.01	8.8
	SOC-4	<8.8	<<0.01	8.8
	SOC-5	65.9	<0.01	8.8
	SOC-6	22.7	<0.01	8.8
	Arithmetic Mean	20.6	<0.01	----

TABLE II. Results of the Asbestos Analyses of Gutter Sediment Samples

	Sample ID	μg/g	% Asbestos	Limit Of Detection μg/g
Bldg No. 2d	G2-1	6092.5	0.61	45.61
	G2-2	3931.1	0.39	45.61
	G2-3	2061.7	0.20	96.29
	Arithmetic Mean	4028.4	0.40	—
Bldg No. 2a	G2/3-1	10967.2	1.10	79.76
	G2/3-2	8342.3	0.83	79.76
	G2/3-3	5308.8	0.53	79.76
	Arithmetic Mean	8206.1	0.82	—
Bldg No. 5	G5-2	24607.0	2.46	256.84
	G5-3	101073.9	10.10	744.85
	G5-4	24785.7	2.48	392.03
	Arithmetic Mean	50155.5	5.02	—
Bldg No. 12	G12-1	23164.5	2.32	180.69
	G12-2	6905.4	0.69	109.17
	G12-3	6226.5	0.62	180.69
	Arithmetic Mean	12098.8	1.21	—

TABLE III. Results of the Asbestos Analyses of Surface Dust Samples from Sidewalks/Pavements

	Sample ID	s/cm^2
Bldg No. 2d	SU2-1	1,554,471
	SU2-2	3,204,393
	SU2-3	3,012,129
	Arithmetic Mean	2,245,714
Bldg No. 4a	SU4-1	742,692
	SU4-2	246,240
	SU4-3	129,802
	Arithmetic Mean	372,911
Bldg 20a	SU20-1	1,610,029
	SU20-2	525,520
	SU20-3	443,579
	Arithmetic Mean	859,709
Control	SUC-1	309
	SUC-2	2,472
	SUC-3	5,563
	Arithmetic Mean	2,781

TABLE IV. Results of the Asbestos Analyses of Surface Dust Samples from Roofs

	Sample ID	s/cm^2
Bldg No. 2d	MV2-1	2.3×10^9
	MV2-2	0.7×10^9
	MV2-3	0.8×10^9
	Arithmetic Mean	1.3×10^9
Bldg No. 2a	MV2/3-1	0.4×10^9
	MV2/3-2	0.2×10^9
	MV2/3-3	1.1×10^9
	Arithmetic Mean	0.6×10^9
Bldg No. 5	MV5-11	1.1×10^9
	MV5-22	1.1×10^9
	MV5-33	2.7×10^9
	Arithmetic Mean	1.6×10^9
Bldg No. 20a	MV20-1	0.18×10^9
	MV20-2	0.02×10^9
	MV20-3	0.18×10^9
	Arithmetic Mean	0.13×10^9

TABLE V. Airborne Asbestos Concentration (S/cm^3) Before and During Street Sweeping Activity

Location	Asbestos Concentration (s/cm^3) Before	During
Building 11 - Laundry Loading Deck	<0.002	<0.001
Quardrex Office - North End	<0.002	<0.001
Building 6 - North End	<0.002	<0.001
Building 20 - North End	<0.002	<0.002
Building 46 - Northeast End	<0.002	<0.001

TABLE VI. PCM Equivalent Airborne Asbestos Concentration (s/cm^3 > 5μm long) Before and During the Street Sweeping Activity

Location	Asbestos Concentration (s/cm^3, > 5μm long) Before	During
Building 11 - Laundry Loading Deck	<0.0003	0.0002
Quardrex Office - North End	<0.0003	<0.0002
Building 6 - North End	<0.0003	0.0002
Building 20 - North End	<0.0003	<0.0002
Building 46 - Northeast End	0.0002	<0.0002